



EXCERPT FROM STATE GEOLOGICAL SURVEY CIRCULAR 248

DOUGLAS COUNTY GROUNDWATER SUMMARY

Sand and gravel deposits favorable for development of domestic and farm groundwater supplies are generally scattered over Douglas County, but in the northwestern and central part of the County they occur somewhat more consistently. Here the drift is as much as 150 feet or more thick in the buried Pesotum Valley and in two minor tributary valleys. Small municipal groundwater supplies have been developed from sand and gravel at Arcola, Arthur, Atwood and Newman.

Pennsylvanian bedrock, consisting principally of shale, underlies the drift in most of the county and locally may yield small groundwater supplies from thin beds of sandstone or creviced limestone or from fractures in the shale. Along the LaSalle Anticlinal Belt (fig. 5, cross section A-A', and fig. 7), bedrock of the Mississippian and Devonian systems directly underlies the drift. In this area groundwater is obtained from the Devonian and underlying Silurian dolomites where drift supplies are not available. Where Mississippian shales underlie the drift, drilling must continue through the shale into the dolomite. Tuscola and Villa Grove obtain groundwater supplies from Silurian and Devonian rocks.

Summary Sample-Study Log of Tuscola Well No. 4,
SW 1/4 NW 1/4 SE 1/4 sec. 34, T. 16N., R. 8E.

Description	Thickness (ft.)	Depth (ft.)
Pleistocene series		
Till, sand, and silt	135	135
Mississippian system		
Shale, some siltstone with thin sandstone bed at base	133	268
Devonian system		
Dolomite, some limestone and thin siltstone beds	154	422
Silurian system		
Dolomite	272	694

At Villa Grove, the municipal wells are finished at depths of 645 and 627 feet into reported Devonian sandstone; the wells penetrate both Pennsylvanian and Mississippian shale. A number of domestic and farm wells also obtain small groundwater supplies from the upper part of the Devonian and Silurian dolomites in this area. Deeper drilling is not recommended at sites which are more than a mile away from the area of outcrop of the Mississippian and Devonian formations (fig. 7).

A public water supply was installed by the city of Tuscola (2838) in 1898. The water works were sold to a private company in 1899 and are now owned by the Illinois Cities Water Co.

A well drilled in 1898 to a depth of 3017 ft., produced about 50 gpm.

Analysis of a sample (Lab. No. 2931) collected Nov. 10, 1898 showed this water to have a hardness of 8.1 gr. per gal., a mineral content of 964 ppm., and an iron content of 1.6 ppm.

In 1904 a surface supply was developed in a small creek west and south of town, a tributary of the Embarrass River. In 1912, two wells were drilled, one to a depth of 850 ft. and the other to a depth of 230 ft. The production from these wells was so small that, in 1914, the supply was obtained from the old deep well and the creek. All three wells were 10-in. diameter and cased to rock. In 1898 the water level in the 3017-ft. well was 28 ft., and in 1914 was 90 ft. below the ground surface elevation of 663 $\frac{1}{2}$ ft. The wells were located at the pumping station (or approximately 2075 ft. S. and 750 ft. E. of the N. W. corner of Section 34, T. 16 N., R. 8 E.).

In 1916, two wells were drilled by Meister Bros., Tuscola, and located near the eastern corporation limits, less than one mile east of the pumping station.

Well No. 1, South Well, was located at the northwest corner of McPherson and Daggy St. and was 287 ft. deep and cased with 8-in. pipe to 118 ft. After 1931, Well No. 1 was used as a standby unit for several years and has now been abandoned. The plunger pump has been removed.

On July 23, 1946 the water level was estimated at 179 ft.

Well No. 2, North Well, was drilled to a depth of 300 ft. and located at the southwest corner of McPherson and Wilson St., 130 ft. north and 20 ft. east of Well No. 1 (or approximately 2180 ft. N. and 420 ft. W. of the S. E. corner of Section 34). The well was cased with 127 ft. 10 in. of 8-in. pipe.

On Mar. 19, 1918, after the pump in Well No. 1 had been operating several hours at 68 gpm., the non-pumping water level in Well No. 2 was 82 $\frac{1}{4}$ ft. and 24 minutes after pumping in both wells, the drawdown in Well No. 2 was 11.54 ft. Well No. 2 was producing 72 gpm.

On Aug. 31, 1927 the combined production from both wells was 75 gpm. as recorded by meter. The pump in Well No. 1 was operated continuously and in Well No. 2 about 3 to 4 hours daily.

In 1945 the pump could not produce more than 75 gpm. and was throttled to that rate. On July 23, 1946 the production rate from Well No. 2 was 27 gpm. The well was then acidized, after which the production was 35 $\frac{1}{2}$ gpm. The non-pumping water level was 91 ft.

The well was maintained as a standby unit until Dec. 1948, when the pump was removed to Well No. 5.

Analysis of a sample (Lab. No. 89981) collected Mar. 5, 1941 showed this water to have a hardness of 13.6 gr. per gal., a residue of 353 ppm., and an iron content of 0.5 ppm.

Well No. 3 was drilled in 1931 to a depth of 523 ft. by Geo. Meister and located about 460 ft. west of Well No. 1 (or approximately 2030 ft. N. and 840 ft. W. of the S. E. corner of Section 34).

The well was cased with 119 $\frac{1}{2}$ ft. of 10-in. pipe below which the hole was 10 in. in diameter to the bottom.

In 1937, when pumping by air lift with 377 ft. of 3-in. eductor pipe, the production was 100 gpm. On June 7, 1946 a production test was made by the State Water Survey. Before the test was started, the pump had been operating for some time. After a 1 $\frac{1}{4}$ -hr. shutdown the water level was 193 ft. below the surface. After 2 $\frac{1}{4}$ -hr. pumping at a final rate of 73 gpm. the drawdown was 121 ft. The drawdown was fairly steady at 18 ft. when the pumping rate did not exceed 70 gpm. Unstable water level conditions occurred when pumping in excess of 71 gpm.

The pumping assembly installed in 1942 consists of 300 ft. of 4-in. column pipe; 7-in., 15-stage Peerless turbine pump, No. 14588, rated at 125 gpm. against 305 ft. of head; the overall length of the pump is 8 ft.; 320 ft. of $\frac{3}{8}$ -in. gi. air line; 30 ft. of 4-in. suction pipe; 15-hp. U. S. electric motor.

Well No. 3 has been maintained as an auxiliary supply unit since Well No. 4 was placed in service on Dec. 15, 1946.

Well No. 4 was drilled in 1946 to a depth of 694 ft. by H. E. Meister and located 20 ft. west

of Ohio, and 120 ft. north of Houghton St. (or approximately 1700 ft. N. and 2040 ft. W. of the S. E. corner of Section 34). The ground elevation at the well site is 663 $\frac{1}{2}$ ft.

Sample-study log of Well No. 4 furnished by the State Geological Survey:

<u>Formation</u>	<u>Thickness</u> ft.	<u>Depth</u> ft.
<u>Pleistocene system</u>		
Soil and till	105	105
No record	10	115
Sand, silty	3	118
Till	4	122
No record	13	135
<u>Mississippian system</u>		
Osage shale, some siltstone	95	230
Kinderhook shale, thin sandstone bed at base	38	268
<u>Devonian system</u>		
Dolomite, some limestone thin siltstone beds	155	422
<u>Silurian system</u>		
Niagaran formation		
Dolomite	404	634
Dolomite, shaly and siltstone	60	694

The well was cased with 12-in. id. pipe from the surface to 170 ft. and 10-in. pipe from 159 to 282 ft. below which the hole is 10-in. diameter to the bottom.

The pump assembly consists of 350 ft. of 5-in. column pipe; Fairbanks-Morse turbine pump, No. AF55138, rated at 125 gpm.; the overall length of the pump is 15 ft.; 380 ft. of 1 $\frac{1}{4}$ -in. gi. air line; 20 ft. of 5-in. suction pipe; 20-hp. General Electric motor, No. TCJ6562216.

A production test was made by the State Water Survey on Oct. 21, 1947. Before the test, the water level was 119 ft. below the surface and after 6 $\frac{1}{2}$ -hr. pumping at a final rate of 143 gpm. the drawdown was 104 ft. At 1 $\frac{3}{4}$ hr. after the shutdown the water level had returned to 135 ft.

Well No. 4 has been the sole source of supply since it was placed in service in Dec. 15, 1946.

Analysis of a sample (Lab. No. 112,250) collected Oct. 21, 1947 after 6 $\frac{1}{2}$ -hr. pumping showed this water to have a hardness of 14.4 gr. per gal., a residue of 412 ppm., and an iron content of 0.5 ppm.

All water is aerated and chlorinated.

Well No. 5 was completed to a depth of 553 ft. in Nov. 1948 by H. E. Meister and is located 50 ft. west of Prairie St. on the center line of Scott St. extended, (or approximately 950 ft. N. and 50 ft. W. of the S. E. corner of Section 34). The ground elevation at the well-site is 660 $\frac{1}{2}$ ft. It was reported that bed rock was encountered at 125 ft.

The well was cased with 12 $\frac{1}{2}$ -in. od. pipe from the surface to 125 ft. and with 10-in. id. pipe from the surface to 135 ft. Below the casing the hole was finished at 10-in. diameter. The annular space between the casings was filled with nine bags of cement. When the well was finished the water level was 112 ft. below the top of the casing.

The pumping assembly, installed in Dec. 1948, consists of 250 ft. of 4-in. column pipe; 10-stage Peerless turbine pump, No. 14233, (removed from Well No. 2) having an overall length of 10 ft.; 30 ft. of 4-in. suction pipe with strainer; 280 ft. of 1 $\frac{1}{4}$ -in. air line; 15-hp. U. S. electric motor No. 285915.

A production test was made on Apr. 19, 1949, using State Water Survey calibrated measuring equipment. Before starting the test, the water level was 126 ft. After 1-hr. pumping at 90 gpm. the drawdown was 18 ft. The pumping rate was gradually accelerated and after a 5-hr. total pumping time at a final pumping rate of 170 gpm. the drawdown was 44 ft. Fifteen minutes after stopping the pump, the water level was 141 ft.

Analysis of a sample (Lab. No. 117920) collected Apr. 19, 1949 after 4 $\frac{1}{2}$ -hr. pumping showed this water to have a hardness of 14.2 gr. per gal., a residue of 498 ppm., and an iron content of 0.6 ppm.

Pumpage from June 21, 1947 to June 21, 1948 averaged 146,900 gpd.

LABORATORY NO. 112,250

		<u>ppm.</u>	<u>epm.</u>			<u>ppm.</u>	<u>epm.</u>
Iron (total)	Fe	0.5		Silica	SiO ₂	16.1	
Manganese	Mn	0.0		Fluoride	F	0.1	
Calcium	Ca	55.3	2.77	Chloride	Cl	25.0	0.71
Magnesium	Mg	26.1	2.15	Nitrate	NO ₃	0.1	Tr.
Ammonium	NH ₄	2.1	0.12	Sulfate	SO ₄	5.6	0.12
Sodium	Na	66.9	2.91	Alkalinity (as CaCO ₃)		356.	7.12
Color		0		Hardness (as CaCO ₃)		246.	4.92
Odor (at well)	H ₂ S			Residue		412.	
Turbidity	Tr.			Hydrogen Sulfide H ₂ S		1.4	
Temperature	59.4° F.						

A public water supply was installed by the village of Atwood (707) in 1935.

Water is obtained from a well drilled to a depth of 97 ft. by John Bolliger and Sons, Fairbury, and located 2350 ft. S. and 200 ft. E. of the N. W. corner of Section 31, T. 16 N., R. 7 E. The ground surface elevation is 672± ft.

The well was gravel-packed. A 24-in. outer casing extended from the surface to 81 ft. 4 in. and a 12-in. inner casing extended from the surface to 81 ft. 3 3/4 in. Below the inner casing was set 17 ft. 1 3/4 in. of Cook screen having No. 187 slot openings.

When the well was completed, a brief production test was made by the State Water Survey. The static water level was 11 1/2 ft. below the ground surface. When pumping at 132 gpm., the drawdown was 23 ft. and when pumping at 190

gpm., the drawdown was 32 1/2 ft. The pumping rate could not be continued at a higher speed or an extended period.

The well is equipped with 85 ft. of 6-in. column pipe; 7-in., 12-stage Fairbanks-Morse Price turbine pump, No. 23038, rated at 140 gpm. against 125 ft. of head at 1720 rpm.; defective air line; 20-hp. Fairbanks-Morse Electric motor, No. 308501.

In June, 1938, the pump was operated twice weekly for a period of two hours each time of pumping.

Analysis of a sample (Lab. No. 115,101) collected June 25, 1948 after 18-minutes pumping showed this water to have a hardness of 24.5 gr. per gal., a residue of 514 ppm., and an iron content of 2.6 ppm.

Correlated driller's log of Well No. 1 furnished by the State Geological Survey:

<u>Formation</u>	<u>Thickness</u> ft.	<u>Depth</u> ft.
<u>Pleistocene system</u>		
Soil and clay	35	35
Sand, dirty	2	37
Clay	16	53
Gravel	4	57
Hardpan	20	77
Sand and gravel	19	96
Hardpan	1	97

LABORATORY NO. 115,101

	<u>ppm.</u>	<u>epm.</u>		<u>ppm.</u>	<u>epm.</u>
Iron (total) Fe	2.6		Silica	SiO ₂	29.5
Manganese Mn	0.0		Fluoride	F	0.2
Calcium Ca	111.8	5.59	Chloride	Cl	3.0 0.08
Magnesium Mg	34.4	2.82	Nitrate	NO ₃	0.2 Tr.
Ammonium NH ₄	2.2	0.12	Sulfate	SO ₄	3.1 0.06
Sodium Na	22.3	0.97	Alkalinity (as CaCO ₃)	468.	9.36
Turbidity	25		Hardness (as CaCO ₃)	421.	8.41
Color	0		Residue	514.	
Odor	Tr.		Free CO ₂ (calc.)	59.	
Temperature 56° F.			pH = 7.3		

LABORATORY NO. 115,180

	<u>ppm.</u>	<u>epm.</u>		<u>ppm.</u>	<u>epm.</u>
Iron (total) Fe	0.15		Fluoride F	0.1	
			Chloride Cl	4.0	0.11
Turbidity	0		Alkalinity (as CaCO ₃)	456.	9.12
Color	15		Hardness (as CaCO ₃)	96.	1.92
Odor	0		Total Mineral Content	475.	
Temperature 59° F.			Free CO ₂ (calc.)	22.	
			pH = 7.7		

The water is aerated, filtered and softened. Analysis of a sample (Lab. No. 115,180) collected June 25, 1948 showed the treated water to have a hardness of 5.6 gr. per gal., a mineral con-

tent of 475 gpm., and an iron content of 0.15 ppm.

Pumpage is estimated to average 26,700 gpd.

A well was completed in Apr. 1956 for the village of Camargo (236). The distribution system has not been installed.

Well No. 1 was drilled to a depth of 165 ft. by Layne-Western Co., Aurora, and located in the east central part of the village in the S. E. 1/4, N. E. 1/4 Section 34, T16N, R9E. The ground elevation at the well is 665+. The well was cased with 10-in. pipe from 1.5 ft. above to 160 ft. below the ground surface.

A production test was conducted on Apr. 13, 1956 by representatives of the Driller, the State Water Survey, and Marbry and Johnson, Consulting Engineers. For test purposes the well was equipped with a gasoline engine-driven turbine pump set at 135 ft. An air line 130 ft. in length was installed. After 6 hr. of pumping at a rate of 37 gpm., the drawdown was 81.5 ft. from a non-pumping water level of 20 ft. below the top of the casing. Thirty min. after pumping was stopped, the water level was 36.5 ft.

Sample study log of Well No. 1 furnished by the State Geological Survey:

<u>Strata</u>	<u>Thickness</u> ft.	<u>Bottom</u> ft.
PLEISTOCENE SERIES		
Silt, yellowish brown	10	10
Gravel, yellowish brown, fine to medium, sandy, very dirty	5	15
Till, gray, gravelly	35	50
Gravel, medium to coarse, angular, sandy	20	70
Till, gray, yellow brown oxidized, very gravelly	30	100
Soil, dark brownish, silty, gravelly, wood fragments	10	110
Silt, light gray to yellow, gravelly	15	125
Gravel, sandy, cherty	5	130
Till, yellowish brown to gray, gravelly, shale pebbles	10	140
PENNSYLVANIAN SYSTEM		
Shale; gray to green; much contamination from above	10	150
Shale, gray	5	155
Shale, gray, coal	5	160
Coal	5	165